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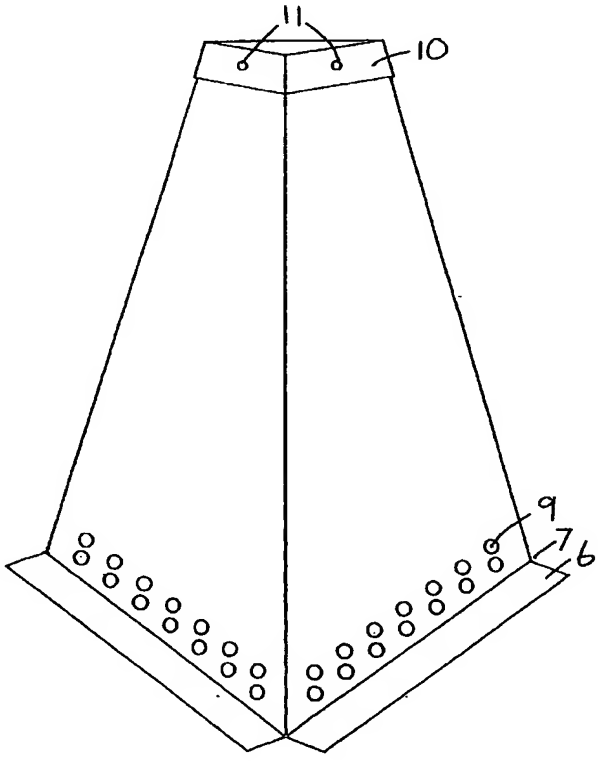

(57) Abstract: A stable shelter for protecting and/or improving the growth of plants, for example saplings, that is convenient to erect, store and transport. A plant shelter comprises a tubular structure that is tapered from a first end to a second end, wherein the first end and the second end are both polygonal, at least one of the first end or the second end is triangular and the tubular structure has at least three edges that extend longitudinally from the first end to the second end.

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Plant Shelter

The present invention relates to a stable shelter for protecting and/or improving the growth of plants, for example saplings, that is convenient to erect, store and transport.

Within the context of the present application, the word "comprises" is taken to mean "includes among other things", and is not taken to mean "consists of only".

Within the context of the present application, the word "ridge" is taken to mean "an elongated raised formation that may be formed from a curved face or from at least two planar faces". A "six-pointed star" is taken to mean any polygonal shape with twelve sides, formed into six points. In its most regular form a six-pointed star is formed by the superimposing one inverted equilateral triangle upon another of equal size. A "six-pointed star" in the context of the present invention is not taken to be limited to a regular star with six equivalent points.

Worldwide, millions of trees are grown for wood production. It can take a number of years from planting for a tree to grow and mature until it is ready for harvesting. Furthermore, saplings are vulnerable to many environmental factors. It has been reported that approximately 15% of saplings planted do not survive to maturity. In view of this it is necessary to protect young, recently planted trees from damage by environmental factors such as high winds or frost, from the encroachment of surrounding vegetation and from damage by wildlife. In addition, due to the length of time that it takes for a tree to mature, means for enhancing the growth of young trees provide significant and highly desirable economic advantages.

Plant protection shelters are known and widely used. However, known shelters do not satisfactorily provide all of the desirable characteristics discussed above.

Known shelters generally comprise a cylindrical tube, a support stake, and a tie. The stake is inserted into the ground in a vertical position, near to a sapling. The tube is placed around the sapling and is secured to the stake by the tie.

Known shelters, as described above, suffer from a number of problems. They comprise separate parts and are therefore time consuming and inconvenient to assemble. In addition, the supporting stake, or sometimes the tube, of known tree shelters generally must be inserted deeply into the ground in order to provide adequate upright support.

Despite the use of a support stake, known shelters lack stability and are therefore susceptible to being displaced, for example by strong winds, thus causing damage to a tree.

Known plant shelters do not provide satisfactory protection against damage caused by wildlife, in particular deer and voles. Deer feed on tree leaves and rub against tree trunks, causing damage by fraying bark, for example with antlers. Known shelters are generally of a shape that resembles a tree trunk and in view of this they are susceptible to damage by deer.

Many known shelters do not provide a good seal between the shelter and the ground, for example they may be attached to the ground at only a single point. Additionally, the base of some known shelters is designed to be buried under a layer of soil. However, this is inconvenient and the base of the shelter is often unsatisfactorily buried, or not buried at all. A weak seal between the shelter and the ground leaves a plant vulnerable to voles that can burrow under the shelter and damage both the shelter and the sheltered plant. Furthermore, a poor seal does not provide optimal conditions for enhancing the growth of young trees, because a poor seal allows cooling from wind or surrounding air. Such cooling can be detrimental to tree growth and may kill a young tree.

A need therefore exists for an improved plant shelter providing greater stability than known shelters and improved protection for newly planted trees. In addition a need exists for a tree shelter that provides growth enhancing conditions for a sapling.

Remarkably, the present invention provides a new plant shelter which addresses the problems of previously known shelters. A shelter according to the present invention has many advantages over known shelters, including improved stability, strength and physical and climatic protection, improved ease of assembly, improved convenience for storage and transport and improved conditions for the promotion of growth and enhancement of survival of newly planted trees.

In a first aspect, the present invention provides a plant shelter which comprises a tubular structure that is tapered from a first end to a second end, wherein the first end and the second end are both polygonal, at least one of the first end or the second end is triangular and the tubular structure has at least three edges that extend longitudinally from the first end to the second end. In use the first end forms the base of the shelter and the second end forms the top.

Advantageously, the tapered shape of a shelter according to the present invention provides increased stability with respect to known shelters. A tapered structure, with a large surface area at the base is inherently more stable than a non-tapered structure, for example a tubular structure of constant diameter.

In a preferred embodiment, the present invention provides a plant shelter wherein the first end and the second end of the tubular structure are both triangular and the tubular structure has three planar sides, the tubular structure being a frusto-pyramid.

Tapered plant shelters are known (GB2128462 & US 5970653). However, in contrast to a shelter according to the present invention these shelters are not of a tubular shape with a first and a second end, both being polygonal, wherein at least one end is triangular. Briefly, GB2128462 discloses a conical shelter that cannot be flat-packed, folded or reused and US5970653 discloses a hexagonal or conical shelter that requires a separate supporting member to be held in an erected configuration. It will be apparent that a shelter according to the present invention provides significant advantages in both protection and the provision of favourable growth conditions.

A shelter according to the present invention comprises a tubular structure that has a first and a second end, both being polygonal, wherein at least one end is triangular. The invention does not include, for example, rectangular or hexagonal frusto-pyramids or conical structures. A shelter according to the present invention provides significant advantages over shelters that comprise conical structures or frusto-pyramidal structures with more than three sides (for example rectangular or hexagonal frusto-pyramids).

Advantageously, a shelter according to the present invention is self-supporting, due to the stability of a tapered structure with at least one end being triangular. This provides significant advantages over known shelters, which may require, for example, a separate upright supporting stake to which the shelter is attached or a separate supporting member to hold the shelter in an erected configuration. A self-supporting shelter according to the present invention is convenient to erect, in contrast to shelters which require the assembly of a separate supporting stake and ties. Convenience of assembly is reflected in the short time required for assembly of a shelter according to the present invention. This is a highly advantageous feature, especially when a large volume of trees are planted.

Advantageously, a triangular frusto-pyramidal structure, with three planar sides or walls, is stronger and more stable than conical structures or frusto-pyramidal structures with more than three walls. A frusto-pyramidal structure with more than three walls, for example a hexagonal frusto-pyramid, is less rigid than a triangular frusto-pyramidal structure of the same material and height. Furthermore, the greater the number of walls a frusto-pyramidal structure has, the less rigid it is. The stability and strength of a shelter comprising a triangular frusto-pyramidal structure provides improved resistance against wind and adverse weather conditions and therefore improved protection against damage that could result from, for example, dislodgment or collapse of the shelter by high winds.

Furthermore, the strength of a shelter according to the invention provides improved protection against damage caused by the physical interference of wildlife.

In addition to its strength, the shape of a shelter according to the present invention provides protection against damage by wildlife, in particular deer. Shelters that comprise conical or cylindrical structures resemble the shape of a tree trunk and are therefore susceptible to damage, for example fraying of the shelter and tree bark by deer mistaking the shelter for a tree and rubbing against it. In contrast, the shape of a plant shelter according to the present invention is distinct from the shape of a tree trunk and is therefore likely to be ignored by deer. Furthermore, a triangular frusto-pyramidal structure, bears less resemblance to a tree trunk than a frusto-pyramidal structure with more than three walls.

Advantageously, the present invention provides a shelter that establishes a microclimate favourable for the growth of a sapling. A structure according to the present invention has a large surface area available for absorption of heat from sunlight and therefore acts like a greenhouse, providing a warm microclimate in which the growth of a sapling is promoted. In contrast, cylindrical, conical and pyramidal structures having more than three walls, of comparable size, provide a smaller available surface area for heat absorption.

Advantageously, the shape of a shelter according to the present invention can facilitate use in close proximity plantations, for example hedges. The base of a shelter according to the invention may be triangular, allowing a plurality or shelters to fit together in a compact array. In contrast, shelters with a circular base cannot be placed in such a compact array and gaps between shelters are unavoidable. Although it may be possible to place shelters with a base with more than three sides in an array with no gaps, the array of, for example, squares or hexagons is inherently less compact than an array of triangles.

Furthermore, a shelter which comprises a triangular frusto-pyramidal structure is cheaper and more efficient to manufacture than a frusto-pyramidal structure with more than three walls.

Advantageously, the shape of a shelter according to the present invention allows effective use on uneven or sloped ground, for example on verges. Previously known shelters are not satisfactorily stable and do not provide a base flush with the ground, when used on uneven or sloped surfaces. The taper of a shelter according to the present invention gives inherent stability. In contrast to non-tapered shelters, the base can be placed on sloping ground, while still allowing a tree to grow vertically through to the apex of the shelter. The shape of the shelter enables this, with the tree growing vertically from any point within the perimeter of the first end or base, through the apex of the shelter.

In a preferred embodiment, the tubular structure has at least one side having a longitudinal strengthening portion. Preferably, the strengthening portion comprises a projection from the side or an indent in the side. More preferably, the strengthening portion is formed by a hollow ridge or trough, wherein the volume inside the tubular structure is uninterrupted and abuts the internal surface of the ridge or trough. Even more preferably, the strengthening portion is formed by a ridge or trough that comprises a curved face or at least two planar faces. Preferably, the strengthening portion is tapered from adjacent the first end to adjacent the second end.

In a preferred embodiment of the present invention, the first end of the tubular structure is defined by a six-pointed star. The structure comprises three strengthening portions which are defined by a hollow ridge that has a pair of planar faces projecting from a surface of the structure lying in a plane that includes two of the edges that extend longitudinally from the first end to the second end. The planar faces of each pair meet at an edge that extends from a point of the star and the ridge is tapered from adjacent the first end to adjacent the second end. Preferably the ridge tapers to a point.

Advantageously, a plant shelter according to the present invention, which comprises at least one longitudinal strengthening portion, has significantly increased strength in comparison to a shelter of the same dimensions and material, without a strengthening portion. A shelter may therefore be produced from a thin material, that would not be strong enough to produce a functional shelter without strengthening portions. A shelter according to this embodiment of the present invention can be produced very economically, with reduced cost of raw materials. A shelter according to this embodiment can, for example, be produced by blow moulding of a thin plastics material.

In a preferred embodiment, the present invention provides a plant shelter which comprises a base-sheet, wherein the first end of the tubular structure is at least partially closed by the base-sheet.

Advantageously, the base-sheet inhibits weed growth in the direct vicinity of a newly planted tree, thus reducing the competition that a newly planted tree is subjected to and enhancing the amount of nutrients available. Inhibition of weed growth reduces the amount of labour intensive maintenance that is required, for example removal of weeds.

In addition, the base-sheet advantageously keeps the internal environment of the shelter moist, which is favourable for enhancing growth of a sapling.

Preferably the base-sheet comprises a membrane that extends across the first end of the structure, for example this may be a polythene membrane.

Preferably, the base-sheet comprises a black membrane. More preferably, the base-sheet comprises a reflective membrane, for example a rigid and/or flexible reflective film. Even more preferably, the reflective membrane comprises a film of about 0.2mm thickness. Preferably the film comprises MYLAR, more preferably it comprises a MYLAR reflective top layer bonded to a white vinyl base film (commercially available as MYLAR-bright white).

Advantageously, the reflective film reflects up to about 92% of light back into the plant shelter, giving a higher overall light level within the plant shelter and thereby promoting better growth of a newly planted tree within the shelter. Furthermore, in sunny conditions a reflective membrane keeps the roots of a newly planted tree beneath the membrane considerably cooler than if no base-sheet or a non-reflective membrane were present. This is beneficial for the healthy growth of a newly planted tree.

Preferably, the membrane comprises perforations that facilitate easy tree planting by allowing the formation of a hole in the membrane for a newly planted tree to extend through. More preferably, the membrane has perforations extending from the central point of the membrane. More preferably the perforations extend from the central point of the membrane to at least one of a side and a corner of the base-sheet.

Preferably, the membrane has at least one slit, through which a tree can extend.

Alternatively, the base-sheet is formed from a rigid material.

Preferably, the base-sheet comprises a hole through which a tree can extend. More preferably the hole is located centrally.

Preferably, the base-sheet comprises a combination of a rigid material and a membrane. More preferably the base-sheet comprises a frame of rigid material located circumferentially inside the edge of the first end of the structure and a membrane that extends across the centre of the frame.

Preferably, the base-sheet has one or more drainage holes to prevent water logging. More preferably the base-sheet comprises a plurality of drainage holes. Even more preferably a drainage hole is located at each corner of the base-sheet.

In an alternative embodiment the base-sheet is detachable from the structure. The base-sheet may be clipped onto the first end of the structure.

A preferred embodiment of the present invention provides a shelter which comprises a fold line located in one side of the structure wherein the fold line longitudinally bisects the side and the structure can be folded into a flat folded configuration along the fold line and an opposite longitudinal edge of the structure. Advantageously, the shelter can be intentionally folded for transportation and reuse. This feature could be referred to as being collapsable.

A preferred embodiment of the present invention provides a shelter wherein the tubular structure is formed from a flat sheet which comprises three panels and a joining strip, wherein each panel adjoins an adjacent panel at an edge that extends longitudinally from the first end to the second end of the structure and the joining strip adjoins a panel along an edge that extends longitudinally from the first end to the second end of the structure, wherein the flat sheet is capable of being folded to form an erected tubular structure in which the joining strip adjoins two panels. The joining strip may overlay at least part of a panel.

Advantageously, a shelter according to the present invention can be conveniently packaged, stored or transported in a flat folded configuration or as a flat sheet, thus enabling a large number of shelters to be placed in a small space. As an alternative, a number of shelters according to the present invention can be stored or transported in an erected configuration. Shelters can be stacked within one another because they taper.

Preferably the flat sheet comprises a number of score lines extending across the sheet identifying the position of folds, wherein the intervals between the score lines define the panels. The shelter is assembled into an erected tubular configuration by folding along the score lines.

Preferably the joining strip is secured by any suitable means, including glue, press studs, staples, arrow and slot fastenings or hook and loop fastenings (for example, Velcro®). More preferably the joining strip is secured releasably.

Advantageously, a shelter according to the present invention may be reversibly converted from an erected configuration to a flat sheet. Once in its erected

configuration, the joining strip of the shelter may be released, to reform the flat sheet. The shelter may therefore be reusable, a feature that could be of particular benefit to domestic tree growers, wishing to keep costs to a minimum, or to growers conscious of wastage, for example for environmental reasons.

Furthermore, this embodiment advantageously facilitates the use of a shelter according to the invention to protect larger plants, for example shrubs and maturing trees, as well as saplings. A shelter in an erected configuration is placed over the top of a sapling, yet may not be able to fit over larger plants. However, a shelter formed from a flat sheet can be wrapped around the stem or trunk of a large plant and secured by the joining strip.

A shelter according to the invention can be removed to avoid strangling of a plant after it has grown to an appropriate size. The shelter can be removed by unfastening the joining strip, thus leaving the shelter available for reuse.

Alternatively, in a preferred embodiment, the present invention provides a shelter that can be broken open by a tree growing within it. Advantageously, this helps to avoid strangulation of a maturing tree and prevents the need for a shelter according to the invention to be checked and removed manually. Preferably the edges of the structure are weakened, for example by scoring, to enable these edges to be split open by the outwards pressure exerted on them by a growing tree.

Preferably, a shelter according to the invention comprises a material that decays in strength with time, facilitating breaking open by a maturing tree. More preferably the material is at least one of photodegradable and biodegradable.

A preferred embodiment of the present invention provides a shelter comprising at least one flap that extends externally from the first end of the tubular structure. Preferably, the shelter comprises one flap that extends radially from the first end of the structure, preferably around the entire circumference of the first end. Preferably, the shelter comprises a flap that extends externally from each side of the structure at the first end. Preferably the flap has a raised outer rim.

Advantageously the flap or plurality of flaps provides a broader overall base area to the shelter, increasing stability.

Preferably each flap has one or more openings through which at least one of an anchor stake and a ground pin can be inserted in order to secure the shelter to the ground. More preferably the opening is defined by a raised rim.

Preferably the ground pin comprises a stem which has a point and a flattened top. More preferably the pin comprises two smaller pointed stems which extend down from the flattened top.

Advantageously, a shelter comprising at least one flap provides increased stability and a strong attachment to the ground. Known shelters, comprising an upright ground support stake to which the shelter is tied, have only one point of attachment to the ground. In contrast, a shelter according to this embodiment of the present invention has a plurality of attachment points, thus providing a secure attachment to the ground.

A shelter according to this embodiment provides a secure and close seal with the ground around the entire periphery of the first end of the shelter. Advantageously, this prevents wind entering the shelter through gaps at the base, thus protecting the tree from cooling air currents that can be detrimental to growth and may kill a vulnerable sapling.

Furthermore, a good seal with the ground around the first end of the shelter provides protection against voles, which can burrow under known shelters and destroy plants.

A preferred embodiment of the present invention provides a shelter which comprises at least one side having at least one of an extensible and a compactable portion. Preferably, the structure has three sides and two of the three sides have at least one of an extensible and a compactable portion adjacent the first end of the structure.

Preferably a side having a compactable portion comprises at least one removable section which can be removed to leave a gap. The remaining sides can be folded and pinned down to close the gap, thus angling the sides with respect to the base. More preferably a removable section is outlined by perforations or a pull-out strip, facilitating easy removal. Even more preferably the shelter comprises at least one tie, for example a nylon tie, for closing the gap created by removal of a removable section.

Alternatively, the extensible or compactable portion comprises a folded bellows or a crumple zone.

Advantageously, the extensible or compactable portion allows the axis extending through the apex of the structure to be angled with respect to the first end, thereby facilitating use of the shelter on sloped ground. The angle can be adjusted in accordance with the degree of the slope, thus providing a shelter that is stable and has a good seal with the ground, even on steeply sloped ground.

A preferred embodiment of the present invention provides a shelter comprising a protective lip extending around the second end of the structure. Preferably, the lip comprises a protective bead moulded or attached circumferentially to the second end of the structure. Alternatively, the lip is formed from a rolled over end of the structure. Advantageously, the lip prevents damage, for example by chafing, that can be caused to the tree as it grows or as it is blown against the shelter by wind. In addition the lip provides extra strength to the shelter.

Preferably a shelter according to the present invention is formed from a clear, opaque or coloured plastics material. This material may be a solid plastics material or a plastics mesh. More preferably a shelter according to the present invention is produced of a translucent plastics material. Even more preferably a shelter according to the present invention is produced of polyvinylchloride (PVC) or polypropylene. A shelter according to the present invention can be produced by cutting from a sheet, blow moulding or injection moulding.

A preferred embodiment of the present invention provides a shelter comprising a material which is corrugated or otherwise ridged in order to provide extra strength. Preferably the material comprises a raised grid pattern. Advantageously this provides good protection from damage that could be caused by environmental factors or physical interference by animals.

In a preferred embodiment a shelter according to the present invention comprises a cap sized to fit on to the second end of the structure. Advantageously, the cap can provide extra protection to a sapling, for example from frost damage.

Preferably, the cap may comprise a clear, opaque or coloured material. The cap may be flat or pyramidal.

Preferably the cap can be fixed to the structure by at least one of a pin, press-stud, staple, interlocking tab, arrow and slot fastening, hook and loop fastening (for example, Velcro®) or any other suitable means.

A preferred embodiment of the present invention provides a shelter that has at least one side having one or more openings for ventilation. Preferably a plurality of openings are spaced equidistantly around the entire periphery of the structure adjacent the first end.

In a preferred embodiment the present invention provides a shelter wherein the sides of the structure have one or more perforated push out openings for ventilation. Preferably the sides comprises a plurality of perforated push out openings. Advantageously this enables the number and positioning of openings to be decided, according to the degree of ventilation required.

Preferably the openings for ventilation are positioned spaced away from the first end to prevent voles from gnawing through the holes.

In a second aspect the present invention provides a plant shelter as described herein comprising two or more tapered tubes that are sized so as to slot together

coaxially. A shelter according to this aspect may therefore be formed from one or more tubes that are assembled together in order to form a shelter of appropriate size and height.

A shelter according to the present invention is preferably about 0.6m in height. At the first end of the structure each side is about 0.3m in width and at the second end each side is about 0.2m in width. Preferably, a larger shelter may also be produced that is about 1.2m in height. A shelter for the protection of a small plant, rather than a tree may be of a smaller size, for example, about 0.3m in height, having sides of about 0.15m in width at the first end and about 0.1m in width at the second end.

Additional features and advantages of the present invention are described in, and will be apparent from, the description of the presently preferred embodiments which are set out below with reference to the drawings in which:

Figure 1 shows a three-dimensional view of one planar side of a shelter according to the present invention.

Figure 2 shows a three-dimensional view of two sides of a shelter according to the present invention

Figure 3 shows a three-dimensional view of a preferred embodiment of a shelter according to the present invention which comprises a cap.

Figure 4 shows a plan view of a shelter according to the present invention, opened out into a flat sheet.

Figure 5 shows a plan view of the base-sheet of a preferred embodiment of a shelter according to the present invention.

Figure 6 shows a view from the top of a preferred embodiment of the present invention, which comprises a base-sheet.

Figure 7 shows a plan view of the flat sheet from which a preferred embodiment of a shelter according to the present invention is formed.

Figure 8 shows a three-dimensional view of the erected configuration of a shelter formed from a flat sheet.

Figure 9 shows a three-dimensional view of one side of a preferred embodiment of a shelter according to the present invention comprising a bellows.

Figure 10 shows a three dimensional view of two sides of a preferred embodiment of a shelter according to the present invention comprising a bellows.

Figure 11 shows a view of one wall of a preferred embodiment of the present invention.

Figure 12 shows an enlarged view of a flap.

Figure 13 and 14 show enlarged views of ground pins.

Figure 15 shows a three-dimensional view of a preferred embodiment of a shelter according to the present invention.

Figure 16 shows a view from the top of a preferred embodiment of a shelter according to the present invention.

For the purposes of clarity and a concise description features are described herein as part of the same or separate embodiments, however it will be appreciated that the scope of the invention may include embodiments having combinations of all or some of the features described.

An erected configuration of a shelter according to the present invention is illustrated in figure 1. The shelter comprises a frusto-pyramidal structure 1 with three planar sides. A first side 2 of the shelter comprises a fold line 3. The shelter can be flattened by folding along the fold line 3 and the opposite edge 4

of the structure. The second end of the shelter comprises a protective lip 5 with a radius of 1.5 mm formed from an edge rolled over on the inside of the shelter only. Figure 2 shows a shelter which comprises a protective lip formed on the inside and outside of the rim of the second end of the shelter.

A flap 6 extends from the first end 7 of each wall and has three holes 8 through which ground pins or anchor stakes can be inserted. The shelter comprises a plurality of pop out openings 9 with a diameter of 10 mm, for ventilation, that may be located approximately half way up the structure as shown in figure 1 or adjacent the first end 7 as shown in figures 2 and 3.

The shelter may comprise a cap 10 which is sized to fit over the top of the shelter, as shown in figure 3. The cap 10 is flat and reversibly secured to the second end of the structure by press studs 11.

A shelter according to the present invention may be open at both ends of the structure. Alternatively, the first end of the structure may comprise a base-sheet 12, which at least partially closes the first end of the structure. This base-sheet may comprise a plastics membrane 13 as illustrated in figure 5. The membrane 13 comprises perforations 14 extending from the centre of the membrane to each corner of the base-sheet. Three drainage holes 15, approximately 8 mm in diameter, are located in the base-sheet. A drainage hole is located at each corner of the triangular base-sheet.

A shelter according to the present invention may be formed from a flat sheet 16, illustrated in figure 7. The flat sheet 16 is folded along pre-scored fold lines 17 in order to form a triangular frusto-pyramidal structure comprising three planar sides and a base-sheet 12. The shelter is secured in an erected configuration, as shown in figure 8, by fixing an overlying joining strip 18 extending from a longitudinal edge of one planar side 19 to an adjacent planar side 20. Figure 8 shows a shelter wherein the overlying joining strip 18 is secured by slot and arrow fastenings 21. The shelter may be assembled prior to use or by folding around the tree and then securing the joining strip 18 in position.

The base-sheet 12 comprises a thin frame 22 of a solid material and a polythene membrane 23 that is bonded to this frame. The shelter comprises flaps 6 that extend from the first end of each planar side and also from each edge of the base-sheet 12. The flaps 6 are of equal size and when the shelter is erected the flaps that extend from the planar sides are positioned atop the flaps 6 that extend from the base-sheet 12. Each flap 6 has a centrally located opening 8 through which an anchor stake or ground pin may extend.

Figures 9 and 10 show a shelter which comprises two walls which have an extensible or compactable portion 24. This portion is a bellows located adjacent the first end of the shelter. By extending or compacting the bellows, the base of the shelter is angled about a hinge 25, located adjacent the first end of a third wall. The hinge is a scored line.

A preferred embodiment of a shelter according to the present invention is shown in figure 11. It comprises a material that has a 3 mm wide and 1 mm raised grid pattern 26 on the walls of the structure to add strength and rigidity.

Figure 12 shows an enlarged view of a flap 6, of 300 mm in length, 40 mm in width and with a general thickness of 1 mm, that extends from the first end of a side of the tubular structure. The flap has a slightly raised outer rim 27 of 2 mm in width and thickness and three openings 8 of 14 mm in diameter, each with a raised rim 28 with a diameter of 30 mm. The raised rims provide strength. A rigid plastics ground pin 29, illustrated in figures 13 and 14, may be inserted through each opening 8 to secure the shelter to the ground. The pin 29 comprises a stem 30 of 230 mm in length which has a point 31 of 20 mm in length and a flattened top 32 of 8 mm in length and 35 mm in diameter. The pin 29 shown in figure 14 comprises two smaller pointed stems 33 which are 15 mm long, located 40 mm from the central axis of the main stem and which extend down from the flattened top 32, of 100 mm by 35 mm by 8 mm.

Figures 15 and 16 show a preferred embodiment of the present invention wherein the first end 33 of the tubular structure is defined by a six-pointed star and the second end 34 is defined by a triangle. The structure comprises three

strengthening portions which are defined by a hollow ridge 35 that has a pair of planar faces 36 projecting from a surface 37 of the structure lying in a plane that includes two of the edges 38 that extend longitudinally from the first end to the second end. The planar faces of each pair meet at an edge 39 that extends from a point 40 of the star and the ridge 35 is tapered from adjacent the first end 33 to a point 41 adjacent the second end 34 of the structure. The plant shelter comprises a flap 42 that extends radially from the first end 33 of the tubular structure, around its entire circumference. As illustrated in figure 16, the edges 38 that extend longitudinally from the first end 33 to the second end 34 of the structure may be slightly rounded as an alternative to sharp edges.

It should be understood that various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the present invention and without diminishing its attendant advantages. It is therefore intended that such changes and modifications are covered by the appended claims.

Claims

1. A plant shelter which comprises a tubular structure that is tapered from a first end to a second end, wherein the first end and the second end are both polygonal, at least one of the first end or the second end is triangular and the tubular structure has at least three edges that extend longitudinally from the first end to the second end.

2. A plant shelter according to claim 1 wherein the first end and the second end are both triangular and the tubular structure has three planar sides, the structure being a frusto-pyramid.

3. A plant shelter according to claim 1 or 2 wherein the tubular structure has at least one side having a longitudinal strengthening portion.

4. A plant shelter according to claim 3 wherein the strengthening portion comprises a projection from the side or an indent in the side.

5. A plant shelter according to claim 3 or 4 wherein the strengthening portion is formed by a hollow ridge or trough, wherein the volume inside the structure is uninterrupted and abuts the internal surface of the ridge or trough.

6. A plant shelter according to any one of claims 3 to 5 wherein the strengthening portion is formed by a ridge or trough that comprises a curved face or at least two planar faces

7. A plant shelter according to any one of claims 3 to 6 wherein the strengthening portion is tapered from adjacent the first end to adjacent the second end.

8. A plant shelter according to any preceding claim wherein the first end is defined by a six-pointed star, and

the structure comprises three strengthening portions which are defined by a hollow ridge that has a pair of planar faces projecting from a surface of the structure lying in a plane that includes two of the edges that extend longitudinally from the first end to the second end, and

the planar faces of each pair meet at an edge that extends from a point of the star, and

the ridge is tapered from adjacent the first end to adjacent the second end.

9. A plant shelter according to claim 8 wherein the ridge tapers to a point.

10. A plant shelter according to any preceding claim which comprises a base-sheet, wherein the first end of the structure is at least partially closed by the base-sheet.

11. A plant shelter according to claim 10 wherein the base-sheet comprises a membrane that extends across the first end of the tubular structure.

12. A plant shelter according to claim 11 wherein the membrane is a polythene membrane.

13. A plant shelter according to claim 11 or 12 wherein the membrane comprises perforations that facilitate tree planting by allowing the formation of a hole in the membrane for a newly planted tree to extend through.

14. A plant shelter according to claim 13 wherein the membrane has perforations extending from the central point of the membrane.

15. A plant shelter according to claim 14 wherein the perforations extend from the central point of the membrane to at least one of a side and a corner of the base-sheet.

16. A plant shelter according to any one of claims 11 to 15 wherein the membrane has at least one slit, through which a tree can extend.

17. A plant shelter according to claim 10 wherein the base-sheet is formed from a rigid material.

18. A plant shelter according to any one of claims 10 to 17 wherein the base-sheet comprises a hole through which a tree can extend.

19. A plant shelter according to claim 18 wherein the hole is located centrally.

20. A plant shelter according to any one of claims 10 to 19 wherein the base-sheet comprises a combination of a rigid material and a membrane.

21. A plant shelter according to claim 20 wherein the base-sheet comprises a frame of rigid material located circumferentially inside the edge of the first end of the structure and a membrane that extends across the centre of the frame.

22. A plant shelter according to any one of claims 10 to 21 wherein the base-sheet has one or more drainage holes to prevent water logging.

23. A plant shelter according to claim 22 wherein a drainage hole is located at each corner of the base-sheet.

24. A plant shelter according to any one of claims 10 to 23 wherein the base-sheet is detachable from the tubular structure.

25. A plant shelter according to claim 24 wherein the base-sheet may be clipped onto the first end of the tubular structure.

26. A plant shelter according to any preceding claim which comprises a fold line located in one side of the tubular structure wherein the fold line longitudinally bisects the side and the structure is foldable into a flat folded configuration along the fold line and an opposite longitudinal edge of the tubular structure.

27. A plant shelter according to any preceding claim wherein the tubular structure is formed from a flat sheet which comprises three panels and a joining strip, wherein each panel adjoins an adjacent panel at an edge that extends longitudinally from the first end to the second end of the structure and the joining strip adjoins a panel along an edge that extends longitudinally from the first end to the second end of the structure, wherein the flat sheet is capable of being folded to form an erected tubular structure in which the joining strip adjoins two panels.

28. A plant shelter according to claim 27 wherein the flat sheet comprises a number of score lines extending across the sheet identifying the position of folds, wherein the intervals between the score lines define the panels.

29. A plant shelter according to claim 27 or 28 wherein the joining strip is secured by any suitable means, including glue, press studs, staples, arrow and slot fastenings or hook and loop fastenings (for example, Velcro®).

30. A plant shelter according to claim 29 wherein the joining strip is secured releasably.

31. A plant shelter according to any preceding claim wherein the plant shelter is breakable by a tree growing within it.

32. A plant shelter according to claim 31 wherein the edges of the structure are weakened, for example by scoring, to enable these edges to be split open by the outwards pressure exerted on them by a growing tree.

33. A plant shelter according to claim 32 which comprises a material that decays in strength with time, facilitating breaking open by a maturing tree.

34. A plant shelter according to claim 33 wherein the material is at least one of photodegradable and biodegradable.

35. A plant shelter according to any preceding claim which comprises at least one flap that extends externally from the first end of the tubular structure.

36. A plant shelter according to claim 35 which comprises one flap that extends radially from the first end of the tubular structure.

37. A plant shelter according to claim 35 or 36 which comprises a flap that extends externally from each side of the structure at the first end.

38. A plant shelter according to any one of claims 35 to 37 wherein the flap has a raised outer rim.

39. A plant shelter according to any one of claims 35 or 38 wherein the flap has one or more openings through which at least one of an anchor stake and a ground pin is insertable to secure the shelter to the ground.

40. A plant shelter according to claim 39 wherein the opening is defined by a raised rim.

41. A plant shelter according to claim 39 or 40 wherein the ground pin comprises a stem which has a point and a flattened top.

42. A plant shelter according to claim 41 wherein the ground pin comprises two smaller pointed stems which extend down from the flattened top.

43. A plant shelter according to any preceding claim which comprises at least one side having at least one of an extensible portion and a compactable portion.

44. A plant shelter according to claim 43 wherein the structure comprises three sides and two of the three sides comprise at least one of an extensible portion and a compactable portion adjacent the first end of the structure.

45. A plant shelter according to claim 43 or 44 wherein a side having a compactable portion comprises at least one removable section which can be removed to leave a gap and the remaining sides can be folded and pinned down to close the gap, thus angling the sides with respect to the first end.

46. A plant shelter according to claim 45 wherein a removable section is outlined by perforations or a pull-out strip, facilitating easy removal.

47. A plant shelter according to claim 45 or 46 which comprises at least one tie, for example a nylon tie, for closing the gap created by removal of a removable section.

48. A plant shelter according to claim 43 or 44 wherein the extensible or compactable portion comprises a folded bellows or a crumple zone

49. A plant shelter according to any preceding claim comprising a protective lip extending around the second end of the tubular structure.

50. A plant shelter according to claim 49 wherein the lip comprises at least one of a protective bead moulded or attached circumferentially to the second end of the tubular structure and a lip formed from a rolled over end of the structure.

51. A plant shelter according to any preceding claim which comprises at least one of a clear, opaque or coloured plastics material and wherein the material may be a solid plastics material or a plastics mesh.

52. A plant shelter according to claim 51 which comprises a translucent plastics material.

53. A plant shelter according to any preceding claim which comprises at least one of polyvinylchloride (PVC) or polypropylene.

54. A plant shelter according to any preceding claim wherein the tubular structure is produced by cutting from a sheet, blow moulding or injection moulding.

55. A plant shelter according to any preceding claim comprising a material which is corrugated or otherwise ridged in order to provide extra strength.

56. A plant shelter according to claim 55 wherein the material comprises a raised grid pattern.

57. A plant shelter according to any preceding claim which comprises a cap sized to fit on to the second end of the tubular structure.

58. A plant shelter according to claim 57 wherein the cap comprises a clear, opaque or coloured material.

59. A plant shelter according to claim 57 or 58 wherein the cap is flat or pyramidal.

60. A plant shelter according to any one of claims 57 to 59 wherein the cap is fixable to the tubular structure by at least one of a pin, press-stud, staple, interlocking tab, arrow and slot fastening, hook and loop fastening (for example, Velcro®) or any other suitable means.

61. A plant shelter according to any preceding claim wherein at least one side comprises at least one opening for ventilation.

62. A plant shelter according to claim 61 wherein a plurality of openings are spaced equidistantly around the entire periphery of the tubular structure adjacent the first end.

63. A plant shelter according to claim 61 or 62 wherein the sides of the structure have at least one perforated push out opening for ventilation.

64. A plant shelter according to any one of claims 61 to 63 wherein the openings for ventilation are positioned spaced away from the first end to prevent voles from gnawing through the holes.

65. A plant shelter as described herein comprising two or more tapered tubular structures that are sized so as to slot together coaxially.

66. A plant shelter according to any preceding claim wherein the tubular structure is about 0.6m in height, at the first end of the structure each side is about 0.3m in width and at the second each side is about 0.2m in width.

67. A plant shelter according to any preceding claim wherein the tubular structure is about 1.2m in height.

68. A plant shelter according to any preceding claim wherein the tubular structure is about 0.3m in height, at the first end of the structure each side is about 0.15m in width and at the second end each side is about 0.1m in width.

69. A plant shelter substantially as described herein with reference to or as illustrated in any of the figures of the accompanying drawings.

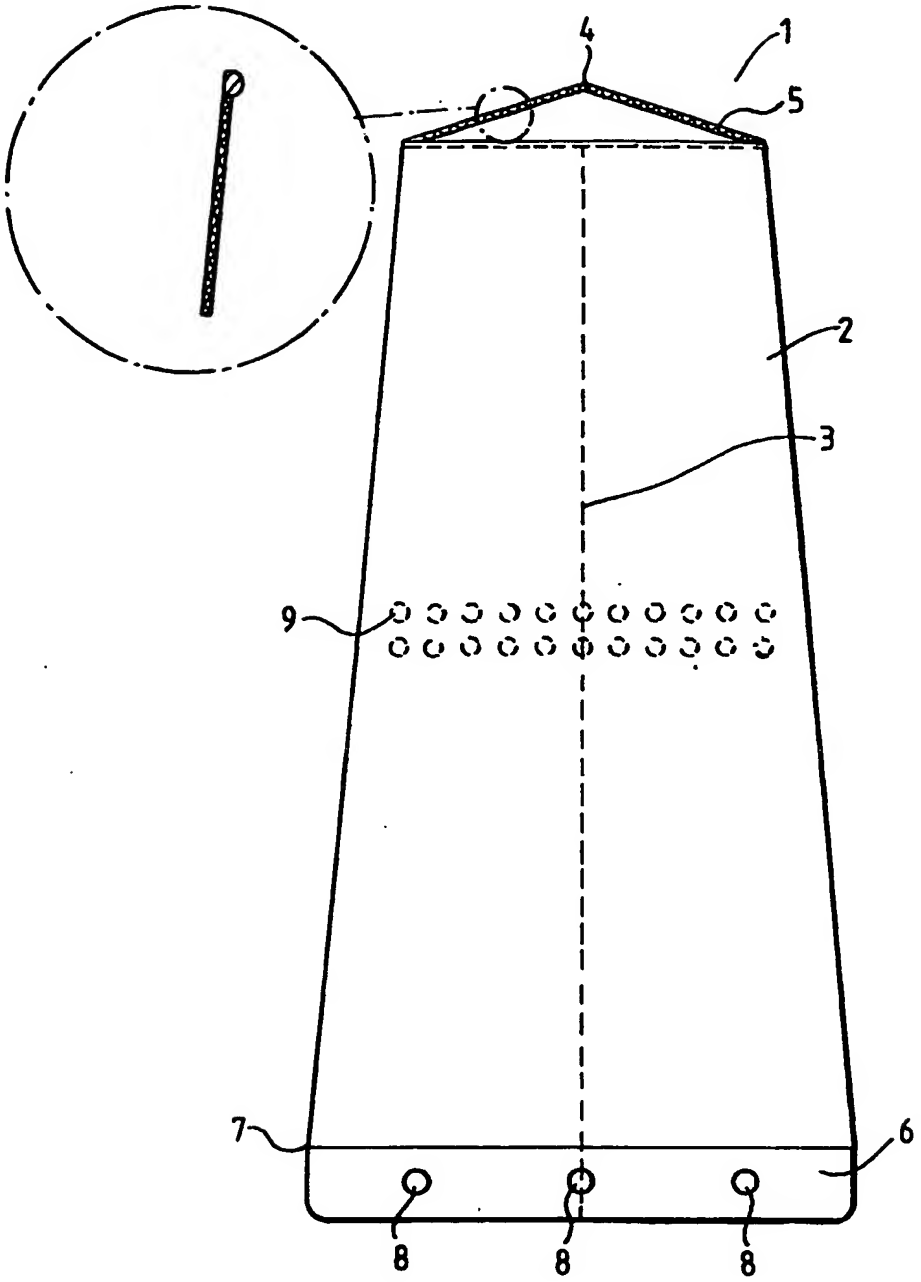


Fig.1.

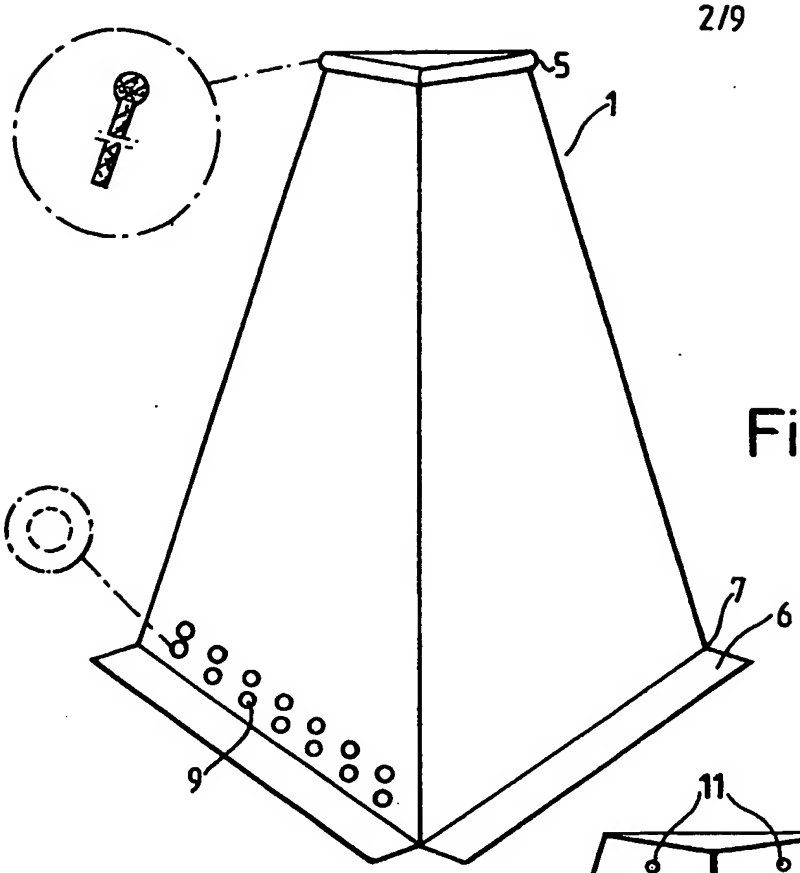


Fig.2.

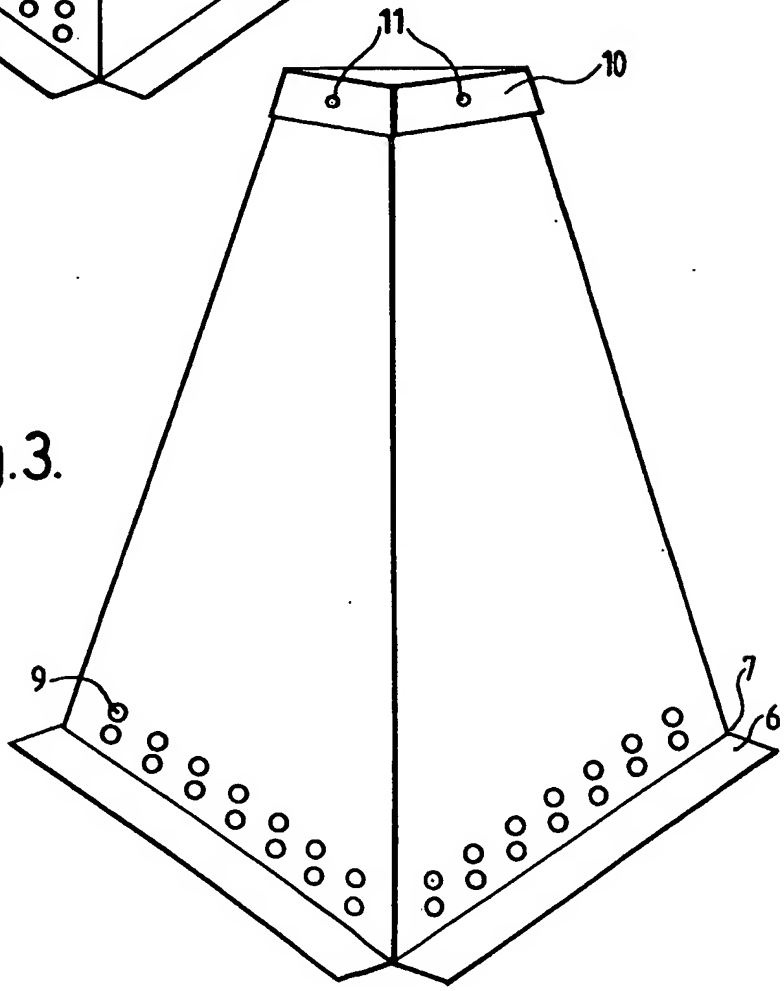


Fig.3.

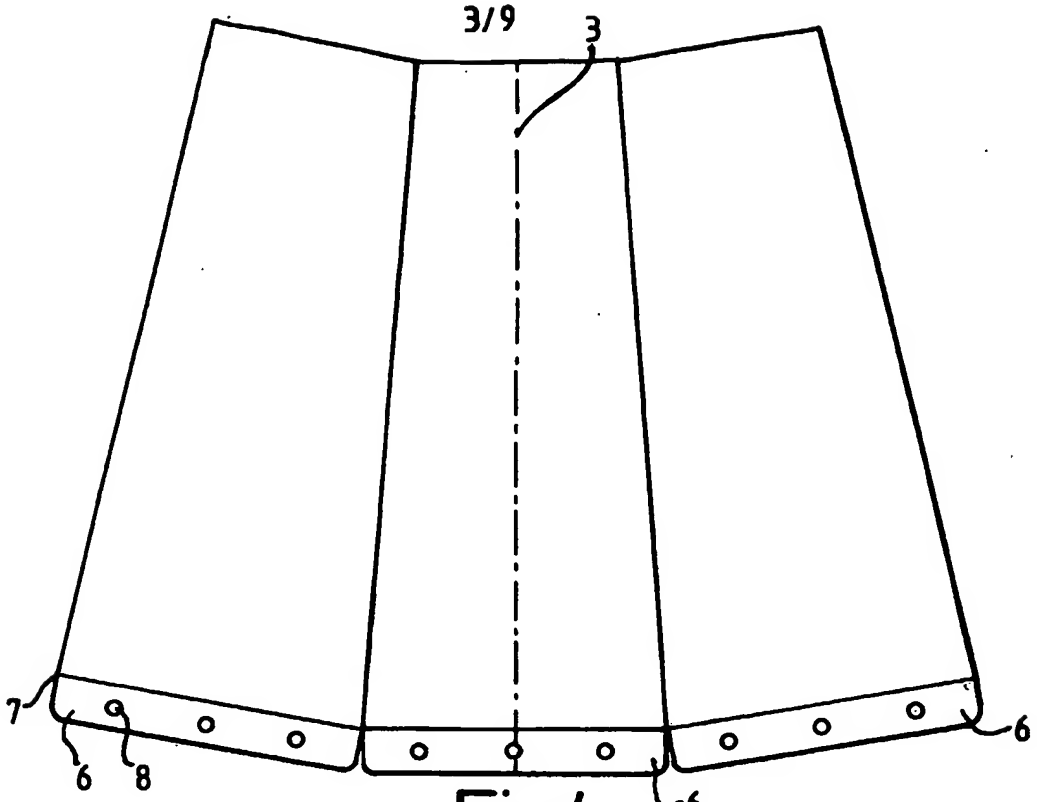


Fig.4.

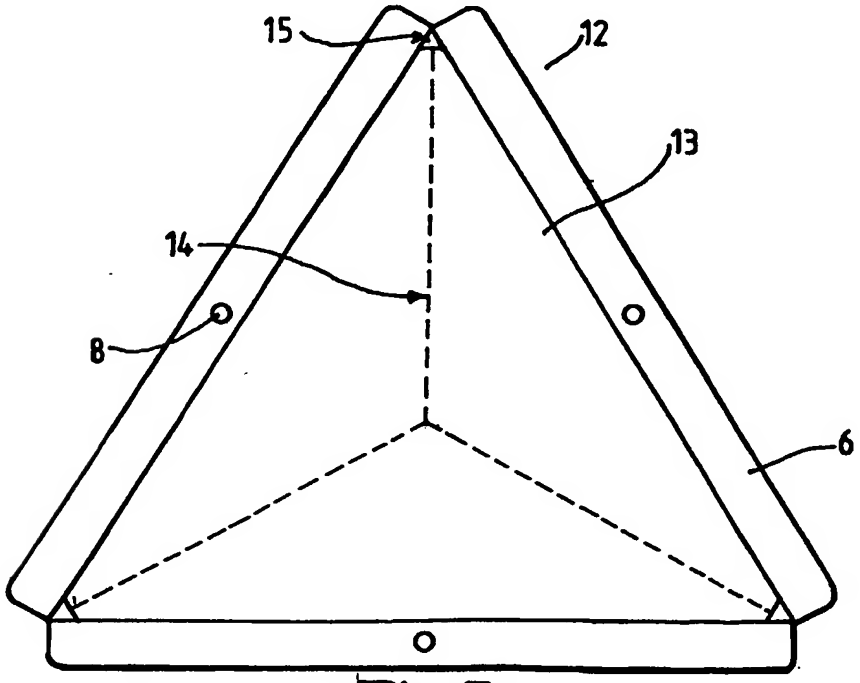
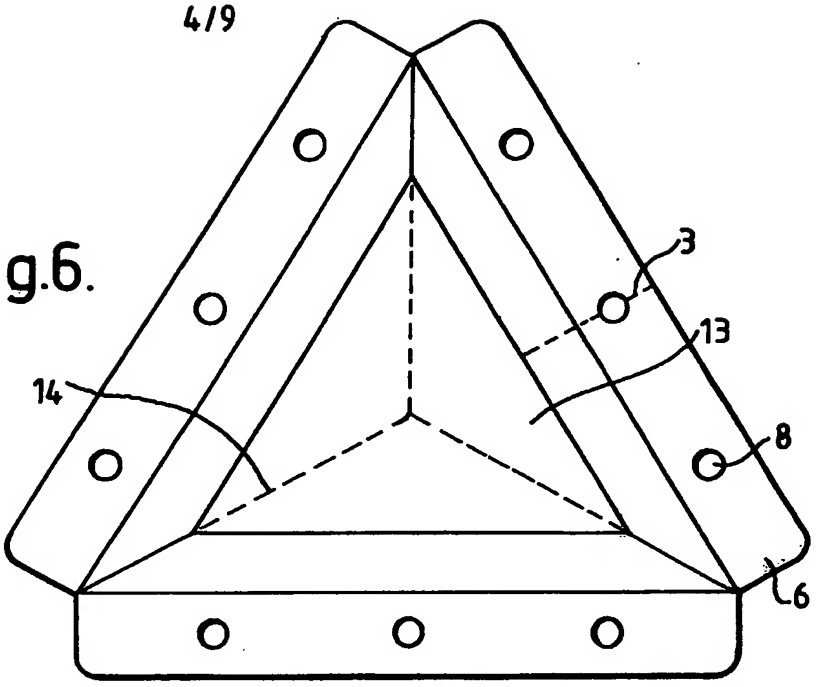


Fig.5.

Fig.6.



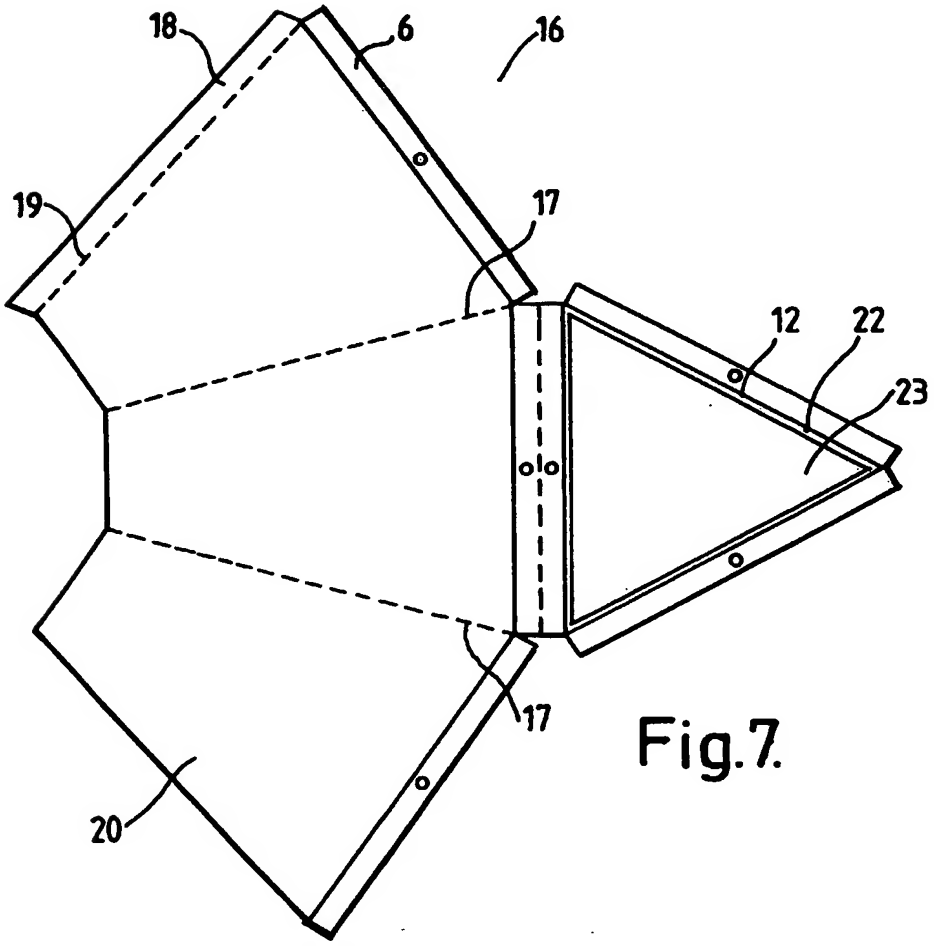


Fig.7.

Fig.8.

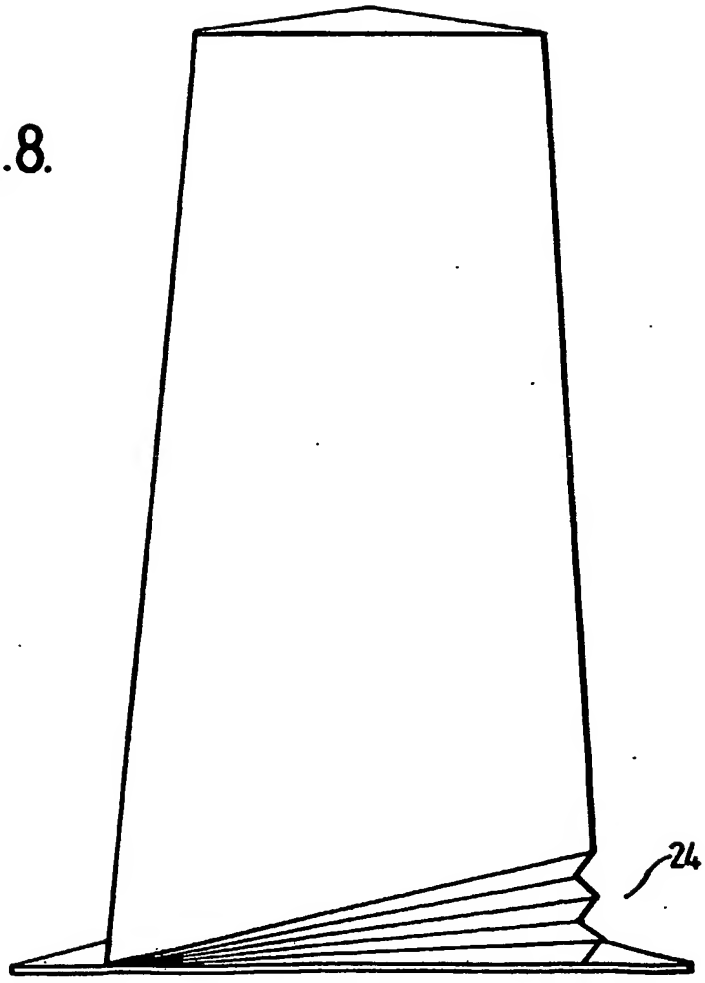


Fig.9.

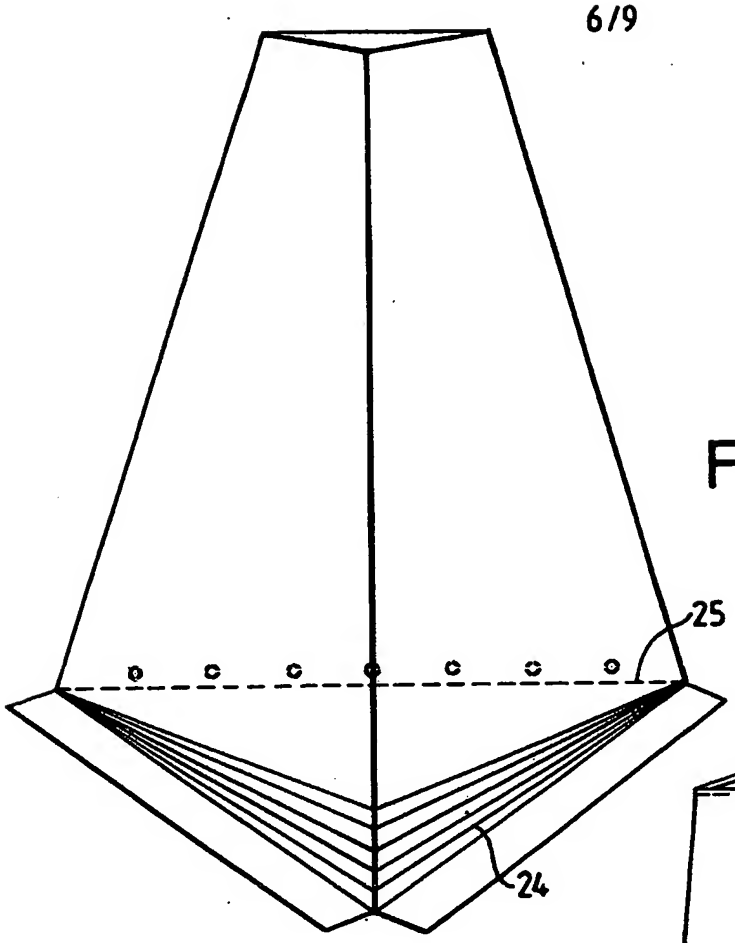


Fig.10.

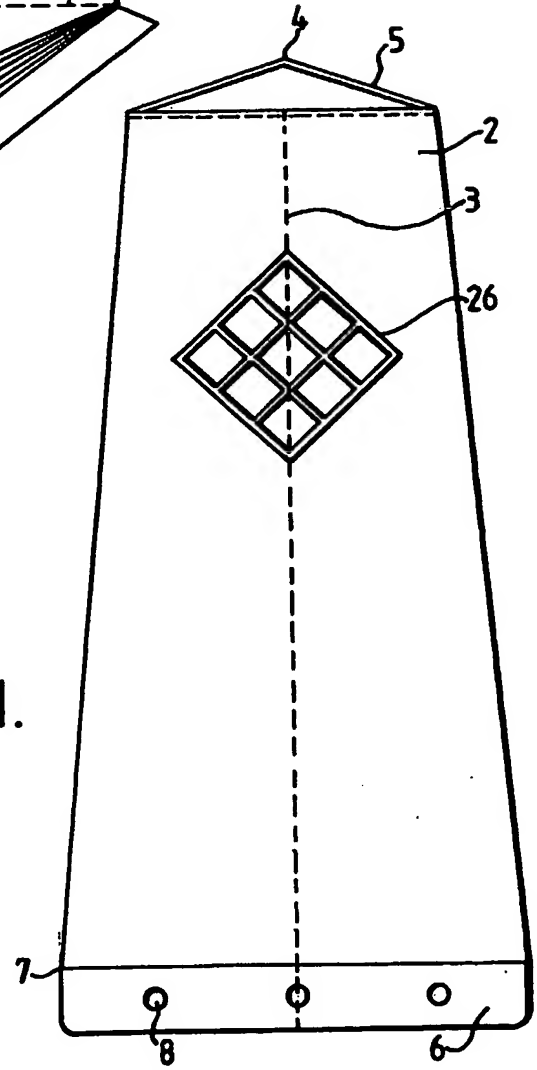


Fig.11.

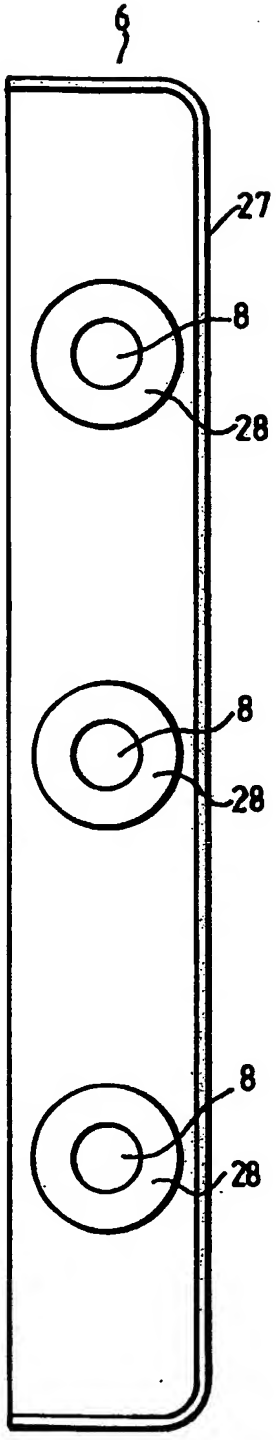


Fig.12.

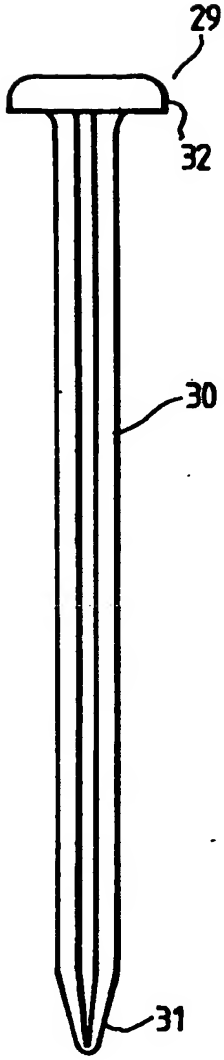


Fig.13.

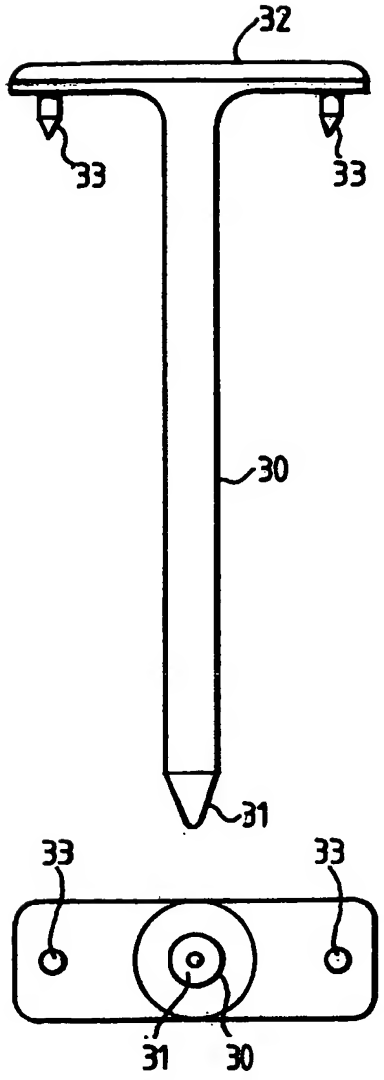


Fig.14.

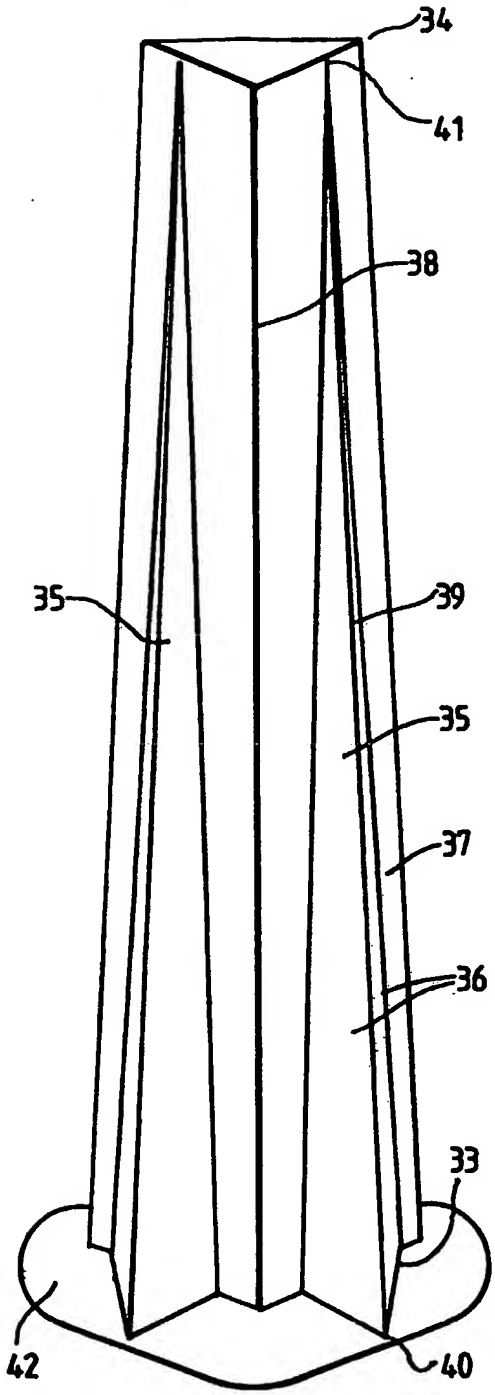


Fig.15.

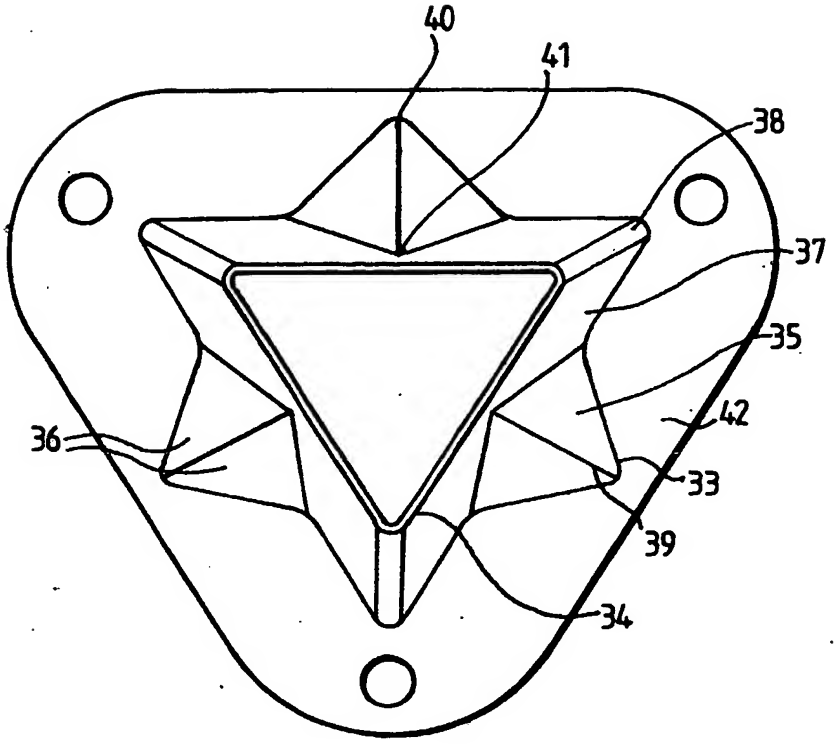


Fig.16.

INTERNATIONAL SEARCH REPORT

Int nal Application No
PCT/GB 03/02165

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A01G13/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A01G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	GB 2 258 797 A (TRILL PAMELA ANNE) 24 February 1993 (1993-02-24) the whole document -/--	1,2,10, 11,16 3-7,9, 17-19, 24,25, 28-30, 34-37, 39,43, 44, 51-64, 66-68

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 September 2003	10/09/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Caldentey Pozo, F

INTERNATIONAL SEARCH REPORT

Int nal Application No
PCT/GB 03/02165

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 970 653 A (LIANG DAOLIN ET AL) 26 October 1999 (1999-10-26) the whole document	28-30, 34-37, 39,43, 44, 51-64, 66-68
Y	US 5 426 887 A (SPENCER HENRY A ET AL) 27 June 1995 (1995-06-27) column 3, line 34 - line 38; figures 1-3	3-7,9
Y	FR 2 612 364 A (KAYSERSBERG SA) 23 September 1988 (1988-09-23) page 5, line 17 - line 23 page 6 page 7, line 1 - line 5	17-19, 24,25

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PCT/GB 03/02165

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US 5426887 A	27-06-1995	CA 2098647 A1	18-12-1994
FR 2612364 A	23-09-1988	FR 2612364 A1	23-09-1988

PUB-NO: WO003096791A1

DOCUMENT-IDENTIFIER: WO 3096791 A1

TITLE: PLANT SHELTER

PUBN-DATE: November 27, 2003

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APPL-NO: GB00302165

APPL-DATE: May 21, 2003

PRIORITY-DATA: GB00211606A (May 21, 2002) , GB00222182A (September 25, 2002)

INT-CL (IPC): **A01G013/00**

EUR-CL (EPC): A01G013/10

ABSTRACT:

CHG DATE=20031210 STATUS=O>A stable shelter for protecting and/or improving the growth of plants, for example saplings, that is convenient to erect, store and transport. A plant shelter comprises a tubular structure that is tapered from a first end to a second end, wherein the first end and the second end are both polygonal, at least one of the first end or the second end is triangular and the tubular structure has at least three edges that extend longitudinally

from the first end to the second end.